case the kidney was gone over very thoroughly, and no evidence of papillary growth was found in the kidney itself.

During the same year I had a case personally of primary carcinoma of the ureter, in which the diagnostic findings were not very unlike Doctor Mathé's, except that it was not possible to force any opaque fluid past the growth. On intravenous injection of neo-iopax, no dye whatever was secreted by the blocked kidney. An unusual feature was that bleeding continued long after the ureteral block was complete, and this came from ulcerated varicosities in the submucosal veins of the ureter for a distance of about seven centimeters below the tumor. X-rays of the pelvis and chest were negative. The diagnosis of ureteral tumor was made in this case, and the kidney and entire ureter were removed at one time. The tumor had adhered to the common iliac vessels. No para-aortic glands were palpable.

Pathological examination showed a ring tumor completely occluding the ureter at the brim of the pelvis, well away from the bladder. The kidney was hydronephrotic and atrophied. It had no tumor. The microscopic diagnosis was that of Doctor Mathé's case, namely, squamous-celled carcinoma primary in the ureter.

The patient is in good condition seven months after operation.

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J. C. Negley, M.D. (527 West Seventh Street, Los Angeles).—Doctor Mathé's presentation of this rather unusual case demonstrates advances made in, and the exactness of diagnostic urology.

In the past six years the patient has had several attacks of left lumbar pains which radiated to anterior left lower abdomen, lasting a few days. Probably the original lesion began then with subsequent stricture of ureter from calculus, inflammatory process localized in ureter or surrounding tissues, with subsequent malignant growth in this area, as malignancy forms on gastric ulcer, rectal lesions, etc.

Malignancy was early and preceded by a long period by other pathology as evidenced by the facts that (*a*) a frozen section failed to demonstrate malignancy, and (*b*) the predominating findings in surgical specimens, frozen sections, regular sections were fibrosis, hypertrophy and scar tissue. If the patient had been cystoscoped and carefully studied any time between his initial attack and the first disabling attack, ordinary cystoscopic treatment might have saved the kidney, or early nephro-ureterectomy would surely have prevented the malignancy.

Autopsy findings and early signs of metastasis indicate that at operation lymph channels had indiscernible invasion (evidenced by extension down descending colon to left side of bladder, the entire bladder and pelvis). Liver involvement indicates a blood invasion, either then or later.

I am in entire accord with all points made by the author, and would emphasize the following:

1. Diagnosis of primary malignancy of the ureter is possible in the majority of cases.

2. Intravenous urography is sadly lacking in exactness of diagnosis, as compared with retrograde urography.

3. Frozen sections, even those made by the most competent pathologists, are often misleading and of undeniable value only when positive.

4. Exactness of diagnosis in urology is unexcelled by any other branch of medicine. However, laity and the profession at large do not always make early or good use of available diagnostic procedures.

5. Doctor Mathé is to be commended for his excellent care of this patient, and surely deserved a more fortunate end-result.

SPINAL CORD INJURIES—THEIR TREATMENT*

By Howard W. Fleming, M. D.
San Francisco

Discussion *by Frederick Leet Reichert, M.D., San Francisco; Edmund J. Morrissey, M.D., San Francisco; Mark Albert Glaser, M.D., Los Angeles.*

ONE of the most difficult problems confronting the surgeon is the care of injuries of the spinal cord. Nor is agreement as to management and treatment to be found in the literature. In view of this situation, a consideration of some of the fundamental facts in relation to trauma of the cord may be of value.

EMERGENCY CARE OF SPINAL-CORD INJURIES

The emergency care of patients with injuries to the spinal cord is extremely important. Neglect, delay or improper treatment will often give rise to complications that materially influence the prognosis as to recovery, the comfort of the patient, and the difficulties and cost of subsequent care.

The original examination and transportation of the patient require care. Rough or careless handling may alter the damage to the cord from a minor to a major contusion. The patient should be placed on an air mattress as soon as possible, for undue pressure on an anesthetic area may devitalize tissue within a few hours. The resultant pressure sore will require months of careful nursing.

SHOCK

It is necessary only to mention that serious shock, if present, is our first consideration. Elaborate methods of diagnosis and treatment must be delayed until the patient's condition warrants their use. Occasionally, associated intra-abdominal injuries, or those of the chest, are not recognized in the presence of serious damage to the spinal cord. More frequently, severe injury to the cord is not appreciated if the patient has an associated injury of the head. The combination of injury to the head and cervical cord is fairly frequent, and must be borne in mind.

CARE OF THE BLADDER

Care of the bladder is an important consideration. There is usually a retention of urine, and all too often the patient is catheterized early. Infection results, and frequent or continuous drainage becomes necessary. Urinary infection is a common cause of death in patients with paraplegia. Often catheterization can be avoided entirely by allowing the bladder to overflow. Several of our patients never have been catheterized, and have had no complications arising from urinary infection. The bladder may reach an alarming size, and it is difficult to resist the urgent demands of the patient, intern, and nurse to empty it. Usu-

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Read before the General Surgery Section of the California Medical Association at the sixty-third annual session, Riverside, April 30 to May 3, 1934.

ally within forty-eight hours, gentle pressure will be effective, and there is little difficulty after overflow begins. Many urologists do not subscribe to such treatment, but, in my experience, the patients who never have been catheterized are spared many or all of the usual urinary complications. This plan is more debatable in patients in whom there is a reasonable certainty that control of the bladder may be restored.

CAREFUL EXAMINATION AND DIAGNOSIS IMPORTANT

Careful examination, as early as the patient's condition warrants, is essential for several reasons. It is important to determine the pathologic change and dysfunction resulting from the injury alone. Increasing signs of dysfunction, or new symptoms superimposed, suggest further hemorrhage, edema, or pressure requiring surgical intervention. Experimental evidence and clinical observation have shown that edema following contusion of the cord is rapid, and that it may reach its peak within a period of from eight to twelve hours. Because of hemorrhage and edema, the cord swells until it completely fills the dural sac. The tension from within and without renders the cord ischemic. This deprivation of circulation destroys the remaining undamaged tissue within the cord and converts a partial destruction of the cord into a complete one. Such an occurrence must be anticipated and prevented.

ROENTGEN-RAY EXAMINATION

Roentgen-ray studies are an important part of the examination. Lateral views, particularly, may show dislocation of a type compatible only with a complete shearing off of all structures in the canal. Partial dislocation, even in the absence of signs of injury to the cord, requires treatment to prevent late sequelae. Occasionally, depressed laminae projecting into the spinal canal indicate the necessity for laminectomy.

SPINAL PUNCTURE

Spinal puncture is one of our most valuable diagnostic aids. It is a simple procedure to introduce a needle into the lumbar space and attach a manometer. It requires far less movement of the patient than the taking of x-ray films, and usually gives greater information as to the presence of pressure on the cord. If jugular compression indicates no block of the spinal canal, it is a fair assumption that operation and decompression are not indicated. On the other hand, if there is a block of the canal, the advisability of operation must be considered.

COMPLETE AND PARTIAL SEVERANCE OF THE CORD

Complete severance of the cord is beyond relief. Partial anatomical lesions, however, frequently give the picture of a total physiological loss. It is not possible to diagnose a complete severance of the cord from the neurological findings alone. We feel that it is reasonable to use the evidence of continuing compression on the cord, as obtained by the manometric interpretation, as one indication for laminectomy. No doubt many patients will be operated on unnecessarily if this rule is followed; on the other hand, some few will be helped materially.

SURGICAL PROCEDURES AND HAZARDS

The question may be raised as to what may be accomplished by surgery, and also as to the dangers incidental to operation. Local anesthesia is usually sufficient and adds little hazard for a patient in fair condition. Great care must be used in exposing the cord, for undue roughness may cause further injury. The exposure of fragments of bone pressing on or through the dura indicates that the operation has been warranted. Extradural hematomata occasionally are found and can be evacuated. In the great majority of cases the dura should be opened to allow inspection of the cord. Frequently the cord fills the canal, and it is necessary to expose the dura well above and below the point of major injury. Often the cord appears normal even at the level at which severe intramedullary damage has occurred. If the cord is badly swollen, and the clinical picture is one of great physiological loss, exploration of the cord itself is in order. A small knife or round needle introduced to either side of the dorsal sulcus will allow evacuation of old blood or broken-down nervous tissue. Frequently the broken-down elements of the cord have the appearance of oil, and pour out under increased pressure. Following such a procedure, the decreased size of the cord, and the return of pulsation, suggest an improved circulation. It may be advisable to leave the dura open if there is any question as to continuance or further increase of pressure.

The greater majority of injuries to the cord are in the low cervical and dorsolumbar regions. The mobility of the spine in these parts, contrasted with the fixation of the thoracic spine, is conducive to dislocation or a combination of fracture and dislocation. Frequently, manipulation with reduction of the dislocation is all that is necessary.

DISLOCATIONS OF CERVICAL VERTEBRAE

In the treatment of dislocations of cervical vertebrae, it has been our practice to use a procedure that, as far as I know, has not been described previously. While it is necessary to reduce the deformity of the spine, it is far more important that the cervical cord be relieved of pressure. Several methods have been described for the reduction of the dislocation. We have found the technique described by Taylor to be the most satisfactory. A halter is placed on the patient's head and fitted as carefully as possible to reduce pain and discomfort to a minimum. The straps of the halter are attached firmly to a belt worn by the operator. This arrangement allows the surgeon the use of his hands in the manipulation of the head and neck; and at the same time he is able to exert a steady and controlled force in extension. Countertraction is best applied to the lower extremities by assistants. It is usually necessary to flex the spine gently before the articular facets can be unlocked. This is followed by further and

stronger traction with gradual extension; and often the reduction can be felt or even heard. If x-ray equipment is available, lateral films may be taken and usually confirm a satisfactory reduction.

It has been our practice to supplement this technique in the following manner: the patient is placed on his side or, in a few instances, in a sitting position, with traction applied from above. A spinal needle is introduced into the lumbar space and a manometer is attached. Jugular compression will indicate the presence of a partial or complete block of the canal. If no block is present prior to manipulation, but occurs during or following the procedure, it is a clear indication that the cord is being compressed and constitutes an outstanding danger signal. On the other hand, if evidence of intraspinal block is corrected by manipulation, one is confident that pressure on the cord has been relieved and, very probably, a satisfactory reduction of the dislocation has been accomplished.

INTRASPINAL BLOCK

We have found that, in some cases, although x-ray films indicate a satisfactory reduction, signs of intraspinal block persist. Occasionally, a slight change in the position of the head and neck will open the canal, and one is able to determine, by means of the manometer, the position that will insure the maximum relief of pressure on the cord. If block is present prior to, and is not relieved by the usual manipulation, one concludes that the cord is so swollen as to occlude the canal. Naturally, this condition increases the hazard of manipulation greatly and open reduction should be considered.

In such cases traction can be applied to the head by means of calipers fastened into the mastoid processes. The laminectomy is carefully done, exposing the cord above and below the point of injury. With the cord in view, heavy traction and manipulation can be made with less hazard of injury to the cord. Often the deformity interfering with the reduction is readily apparent, and can be corrected by the open method.

We feel that the use of the Queckenstedt test as an adjunct during the manipulation of cervical dislocations has many advantages. Its use will indicate the relief, the continuation, or the imposition of pressure on the cord as the result of a necessary but fairly hazardous procedure. In the final analysis, the condition of the cord is our chief concern, and deformity of the vertebrae is of secondary consideration. I do not mean to imply that we should not make every effort to prevent and correct deformity of bone, but I do feel that, frequently, treatment is directed along improper lines. Too often a patient with an injury to his back is subjected to an operation to immobilize the spine, without consideration as to investigation and treatment of injuries to the cord and nerves.

If deformity of the spine persists or recurs in spite of therapy, the cord may be subjected to continued or additional pressure. Intraspinal block, or the delayed sequelae of complications suggestive of involvement of the cord, indicates the necessity for operation. In neglected cases it is usually impossible to correct the deformity of bone causing pressure on the anterior surface of the cord. Removal of laminae may afford some relief of pressure. Much of the traction of the dura and cord caused by angulation may be relieved by cutting the dura laterally and transversely, above and below the point of stricture. If this is not done, the dura, which is most inelastic, acts as a bowstring and increases tension on the cord.

INJURIES OF THE CAUDA EQUINA

Special consideration must be given to injuries of the cauda equina. Here one is dealing with nerve tissue somewhat analogous to peripheral nerves. Regeneration is possible, and every effort should be made to facilitate repair. Frequently the injury is in the region of the first lumbar or twelfth thoracic vertebra. Even though the conus is irreparably injured by extensive dislocation, lesions of the roots and cauda equina are amenable to treatment. If the patient regains flexion of the thighs, his ability to get about in a chair is greatly improved.

Hyperextension often will reduce the dislocation. In these cases the use of the Queckenstedt test is also of value. If hyperextension does not relieve the block, laminectomy is in order. Painstaking hemostasis, careful removal of clots and separation of the roots may prevent the organization of blood and nerve elements into a dense mass of scar tissue with resultant compression of the elements of the cauda equina. Laminectomy in injuries of the cauda equina is somewhat comparable to the neurolysis of peripheral nerves.

A PLAN OF PROCEDURE IS DESIRABLE

It is probably true that, in cases in which the cord has been very slightly or, in contrast, very seriously contused, the type of treatment used will not alter the prognosis materially. In the borderline cases, therapy often will determine the extent of permanent disability. Recourse to the textbooks and literature indicates great confusion on this subject, and disagreement as to treatment. It is necessary, at least, to have some plan in mind when faced with the problem of caring for injuries of the spinal cord. Adherence to the foregoing suggestions has been helpful in providing such a plan—one in which I have learned to place confidence.

TO SUMMARIZE

For the sake of emphasis, I conclude with the following summary:

1. The emergency treatment of injuries to the spinal cord is extremely important. Great care must be used to prevent further injury. Shock must be recognized and treated promptly. The possibility of coincidental or complicating injuries must be borne in mind.

2. The patient should be placed on an air mattress at once. Delay of a few hours only in this detail usually means many months of unnecessary care of a pressure sore.

3. The great majority of patients should not be catheterized. A urinary tract once infected is a constant menace to both the well-being and the life of the patient.

4. New and increasing signs of damage to the cord indicate the necessity for active treatment. X-ray evidence of bone or foreign body pressing on the cord suggests the advisability of operation.

5. Compression of the spinal cord impairs the venous and arterial circulation. This, in turn, retards repair, and may further jeopardize fibers and cells of the cord that are still viable.

6. The Queckenstedt test is our best means of determining whether the cord is compressed, and a positive test is one indication for manipulation or operation.

7. The use of the Queckenstedt test at the time of manipulation or reduction of a dislocation of cervical vertebrae is extremely helpful.

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DISCUSSION

FREDERICK LEET REICHERT, M.D. (Stanford Hospital, San Francisco).—Doctor Fleming's article on the injuries of the spinal cord and their treatment emphasizes the importance of careful examination and an early diagnosis. The use of the Queckenstedt test, as an aid in determining whether a severe injury to the cord has led to a complete block, and particularly the use of this test after the reduction of dislocated cervical vertebrae is an excellent adjunct in deciding whether operative interference is indicated.

One cannot emphasize too strongly the fact that once paraplegia has developed, following a spinal cord injury, pressure sores will occur within just a few hours.

The use of hot-water bottles to overcome shock seems to do more harm than good in such cases, since the burns that develop become major factors in treatment, and the treatment of shock by other means would have led to less disastrous results.

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EDMUND J. MORRISSEY, M.D. (234 Medical Building, San Francisco).—The plan outlined by Doctor Fleming for the treatment of spinal cord injuries is excellent. It emphasizes the importance of nursing care and the proper treatment of the bladder, and is neither too radical nor too conservative.

There is no subject in the field of neurological surgery in which there is such a wide divergence of opinion. This will continue because we are unable to distinguish, in the first few weeks, between an anatomical and a physiological interruption; and when improvement does follow surgery it is impossible, as a rule, to say with any degree of certainty that such betterment is the direct result of the operative intervention.

There is no doubt that in the great majority of cases the damage takes place immediately as a result of direct injury and, therefore, the results of surgery are disappointing. The conditions which might justify operation are, first, a block as demonstrated by the Queckenstedt sign, which is not relieved by reduction of the dislocation; second, impingement into the canal of fragments of bone as demonstrated by x-ray; and third, increasing neurological findings.

Operation offers more hope when the lesion involves the cauda equina. In one case I found the dura torn and one of the edges with two posterior roots caught in between the fracture of the lamina.

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MARK ALBERT GLASER, M. D. (727 West Seventh Street, Los Angeles).—Doctor Fleming has carefully emphasized the importance of the jugular compression test, and has added a very valuable addition to be used in cervical and cauda equina injuries. These new points that Doctor Fleming brought up are extremely ingenious, and one cannot compliment him sufficiently for such keen observations.

Spinal concussion is quite possible, and may be compared with cerebral concussion. The results of spinal concussion with edema and pin-point hemorrhage would be a complete paraplegia. Personally, I have had the opportunity of seeing several cases wherein the bullet wound grazed the vertebral column, but did not cause a dislocation. A few of the particles of lead were visible along the body of the vertebra where the bullet had touched. The result was a complete paraplegia. The jugular compression response was normal, and there was no blood upon spinal puncture. From this we may assume a cord edema with pin-point hemorrhage.

In view of the dehydrating effects of glucose and other solutions in cases of head injury, we thought it advisable to carry out such therapeutic measures with the hope that some good could be accomplished.

Spinal injury also simulates skull injury in that the damage to the underlying nervous tissue is not always related to the bony destruction. Furthermore, sequelae arising secondary to spinal injuries which are not based upon any organic pathology are extremely incapacitating. The severity of the injury has no relationship to the development of the various types of backache that may occur.

Additional measures must be directed to the treatment of such signs, and efforts made to combat the existing neurosis. Often it is impossible without a *subrosa* investigation to clinically differentiate the malingerer from the psychoneurotic.

MALARIAL TREATMENT OF GENERAL PARESIS*

By F. J. VAN METER, M. D.
Norwalk

DISCUSSION *by Clifford W. Mack, M.D., Livermore; Samuel D. Ingham, M.D., Los Angeles; G. Creswell Burns, M.D., Compton.*

MALARIAL treatment of neurosyphilis has long ago passed the stage of experiment and doubt, and has established itself as a standard remedial measure, as a result of the encouraging reports concerning its use from all over the country. No disease, perhaps, has presented such an utterly hopeless outlook as general paresis until the advent of the arsenicals; and even then, with that advantageous treatment, the results were not all that could be desired. However, admittedly there was a general improvement in a certain group of those who received the drug treatment.

Now, inoculation with malaria has gradually brought an increase in the number of improved patients beyond that seen as a result of treatment with arsenicals, and is, therefore, due to receive such credit as it may. This is borne out by the experiences of many men everywhere, and the literature is replete with improved percentages, all the way from 15 to 35 per cent—something unknown and scarcely hoped for in the years gone by.

CLINICAL MATERIAL STUDIED

In December of 1926, a small group of seven patients in the Norwalk State Hospital were in-

* Read before the Neuropsychiatry Section of the California Medical Association at the sixty-third annual session, Riverside, April 30 to May 3, 1934.